REMARKS

Claims 1, 3-7 and 19-36 are pending in this application, of which claim 1 has been amended and claims 31-36 have been newly added. Reconsideration of the rejections in view of these amendments and the following remarks is respectfully requested.

Rejections under 35 USC S § 103(a)

Claims 1 and 7 were rejected under 35 U.S.C. § 103(a) as being obvious over Uglow et al (U.S. Patent No. 6,251,770) in view of Huang et al (U.S. Patent No. 6,060,379).

Admitting that Uglow et al does not teach the contact hole having a portion whose cross section area gradually increases toward an upper level in the first kind of insulating layer, the Examiner alleged:

> . . . it would have been obvious . . . to use a contact hole having a gradual increase toward an upper level as Huang et al. teaches that this is well known and conventional in the art, and an inherent result of the gradual increases is a conformal barrier layer that aids in the adhesion of the embedded conductive layer while preventing the diffusion of the embedded layer.

Claim 1 has been amended to recite "wherein said contact hole has an upper portion whose cross sectional area gradually increases toward an upper level and reaches said bottom surface of said wiring trench in said first kind of the insulating layer and a portion with uniform cross sectional area connected below said upper portion."

In Huang et al, the cross sectional area of the contact hole constantly increases toward an upper level, and there is no "lower portion with uniform cross sectional area.

Thus, Huang et al does not teach or suggest "wherein said contact hole has an upper portion whose cross sectional area gradually increases toward an upper level and reaches said bottom surface of said wiring trench in said first kind of the insulating layer and a portion with uniform cross sectional area connected below to said upper portion."

The stack structure of the interlayer insulating layer and the dual damascene wiring structure are very closely related. The damascene wiring structure is closely related with the manufacturing process. The Examiner admits that Uglow does not teach the contact hole having a portion whose cross sectional area gradually increases toward an upper level in the first kind of insulating layer. Huang, Figs. 1E, 2E and 5E, is cited to supplement this deficiency of Uglow.

Uglow, Fig. 10B shows an interlayer insulating stack structure of an etch stopper film 102', and dielectric layers 104' and 106' of different etching characteristics, and a dual damascene structure including a wiring trench formed in the dielectric layer 106' having a bottom surface and a side wall, and a contact hole extending from the bottom surface of the wiring trench to a surface of the conductive region through a remaining thickness of the interlayer insulating film and through the insulating etch stopper layer.

On the other hand, Fig. 1E of Huang shows only a single inter-metal dielectric (IMD) layer 104 covered with an antireflection film 105. Figs. 1A-1E of Huang shows a first-via process, and the etching step of Fig. 1D over-etches a surface portion of the underlying conductive region. Thus, because the interlayer insulating stack structure of Huang is significantly different from that of Uglow, there is no reason or motivation for a person of ordinary skill in the art to employ the Huang's Fig. 1E structure in the structure of Uglow.

Moreover, Fig. 2E of Huang show an interlayer insulating stack structure including a first dielectric layer 204a, a silicon nitride layer 206, and a second dielectric layer 204b, covered with an antireflection layer 205. The interlayer stack structure is significantly different from that of Uglow. The silicon nitride layer 206 can serve as an etching stopper as shown in Fig. 2D. Control of etching becomes easy by the use of an etching stopper, but silicon nitride has a higher dielectric constant than silicon oxide. Uglow forms a wiring trench in a low k dielectric layer 106'. If silicon nitride layer is disposed at the bottom of the wiring trench, the parasitic capacitance will increase significantly. Therefore, a person of ordinary skill in the art would not employ the interlayer insulating stack structure, and the dual damascene structure of Huang in Fig. 10B structure of Uglow.

Although the applicant's invention does not exclude the use of an etch stopper layer, the wiring trench should not expose the etch stopper layer.

Fig. 5E of Huang shows an interlayer insulating stack structure of first dielectric layer 504a, an anti-reflection layer 505, and a second dielectric layer 504b, without the top anti-reflection layer. Huang states that the antireflection layer 505 has two uses: 1) anti-reflection layer, and 2) etching stopper layer (column 5, lines 38-50). The anti-reflection 505 is used as an etching stopper in the etching step of Fig. 5D. Such anti-reflection layer is typically made of silicon nitride. Similar arguments as for Fig. 2E can also be applied here.

For at least these reasons, amended claim 1 patentably distinguishes over Uglow et al and Huang et al. Claim 7, depending from claim 1, also patentably distinguishes over the cited references for at least the same reasons.

Claims 3-6 and 19-26 were rejected under 35 U.S.C. § 103(a) as being obvious over Uglow et al in view of Huang et al, and further in view of Tsai et al (U.S. Patent 6,319,814 B1).

Claims 3-6 and 19-26, directly or indirectly depend from claim 1. Tsai et al has been cited for allegedly disclosing additional recitations in these dependent claims. Such disclosure, however, does not remedy the deficiencies of Uglow et al and Huang et al discussed above.

Claims 3-6 and 19-26, directly or indirectly depending from claim 1, also patentably distinguish over the cited references for at least the same reasons.

Claims 27-30 were rejected under 35 U.S.C. § 103(a) as being obvious over Uglow et al, as modified by Huang et al, and further in view of Huang (U.S. Patent No. 6,096,595).

Claims 27-30, directly or indirectly depend from claim 1. Huang has been cited for allegedly disclosing additional recitations in these dependent claims. Such disclosure, however, does not remedy the deficiencies of Uglow et al and Huang et al discussed above.

Claims 27-30, directly or indirectly depending from claim 1, also patentably distinguish over the cited references for at least the same reasons.

In view of the aforementioned amendments and accompanying remarks, claim 1, as amended, are in condition for allowance, which action, at an early date, is requested.

If, for any reason, it is felt that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney at the telephone number indicated below to arrange for an interview to expedite the disposition of this case.

In the event that this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. Please charge any fees for such an extension of time and any other fees which may be due with respect to this paper, to Deposit Account No. 50-2866.

Respectfully submitted,

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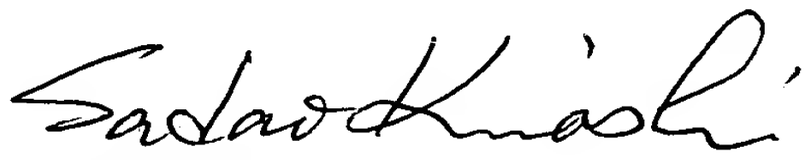

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